Attachment 3:

Examples of Current Status Assessments for Interior Columbia Chinook and Steelhead Populations

Part 1: Wenatchee River Spring Chinook Salmon Population

Part 2: Umatilla River Summer Steelhead Population

Wenatchee River Spring Chinook Salmon Population Current Status Assessment

The Wenatchee Spring Chinook population is part of the Upper Columbia ESU that only has one extant *MPG* including 3 current populations—Wenatchee, Entiat, and Methow Rivers, and one extinct population, the Okanogan (ICTRT 2004). General descriptions of the subbasins and life history characteristics of these populations are provided in the Wenatchee River Subbasin Plan (NPPC, 2004) and the Upper Columbia Recovery Plan (UCSRB 2006).

The Interior Columbia Basin Technical Recovery Team (ICTRT) classified the Wenatchee River Spring Chinook population as "very large" in size based on historical habitat potential (ICTRT 2005). This classification requires a minimum abundance threshold of 2000 wild spawners with sufficient intrinsic productivity (greater than 1.75 r/s measured to spawning) to exceed a 5 % extinction risk on the viability curve (ICTRT 2005). Additionally, the Wenatchee Spring Chinook population was classified as a "type B" population (based on historic intrinsic potential) because it has dendritic tributary structure with multiple major spawning areas (ICTRT 2005).

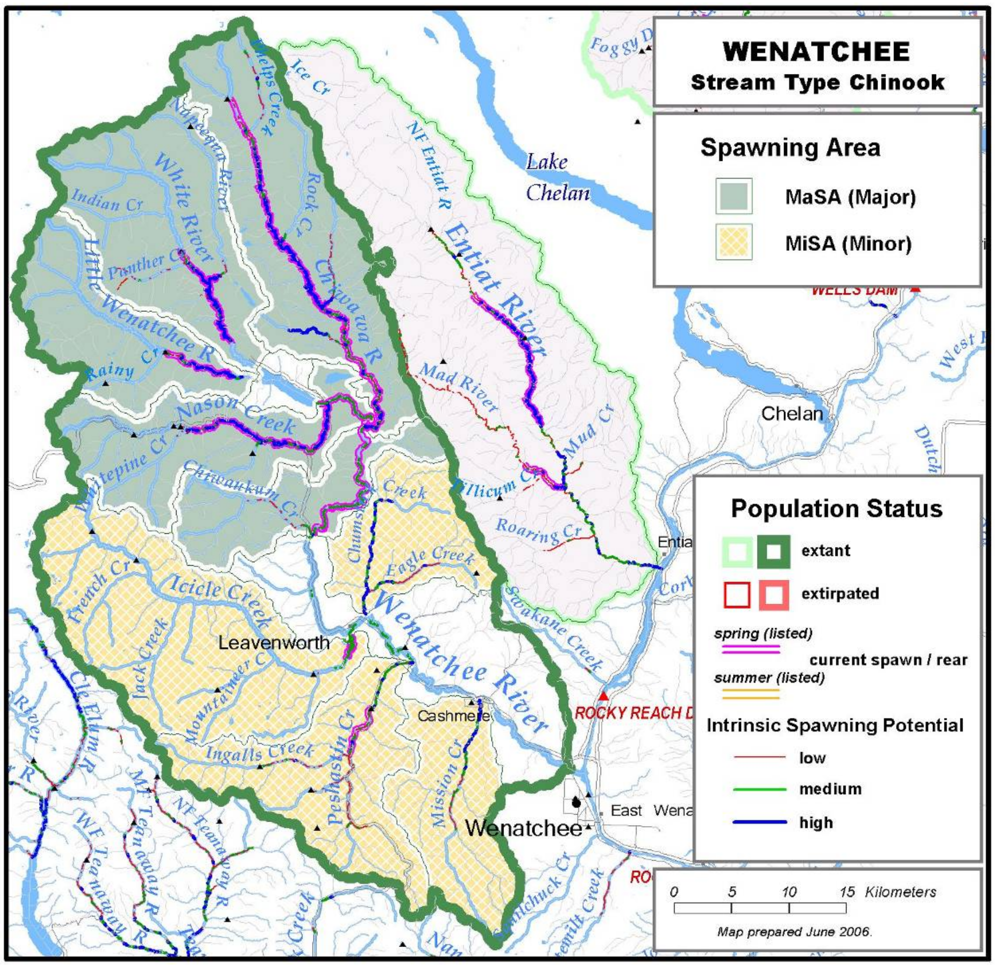

Figure 1. Wenatchee River Spring Chinook Salmon population boundary and major (MaSA) and minor (MiSA) spawning areas.

Table 1. Wenatchee River Spring Chinook Salmon population basin statistics and intrinsic potential analysis summary.

Drainage Area (km2)	3,440
Stream lengths km[a] (total)	1,733.2
Stream lengths km[a] (below natural barriers)	1,082.1
Branched stream area weighted by intrinsic potential (km2)	1.360
Branched stream area km2 (weighted and temp. limited)[b]	1.336
Total stream area weighted by intrinsic potential (km2)	1.883
Total stream area weighted by intrinsic potential (km2) temp limited[b]	1.798
Size / Complexity category	Very Large / B (dendritic structure)
Number of Major Spawning Area	5
Number of Minor Spawning Area	4

[a]All stream segments greater than or equal to 3.8m bankfull width were included
[b]Temperature limited areas were assessed by subtracting area where the mean weekly modeled water temperature was greater than 22^{o}C.

Current Abundance and Productivity

Recent (1960 to 2003) abundance (number of adult spawning in natural production areas) has ranged from 6,718 (1966) to 51 (1995). Abundance estimates are based on expanded redd counts (relatively complete coverage, temporal and spatial components). The results of annual redd surveys are summarized in annual reports and technical memos (e.g., Mosey and Murphy 2002). Prior to 1987, spring chinook redd counts were based on a single survey completed during or after peak spawning activity. The single survey index areas were the most heavily spawned stream reaches. Since 1987, redd counts in the Wenatchee River basin have been based on multiple surveys and include most of the available spawning habitat (Beamesderfer et al., 1997). Since 1995, age composition and hatchery contribution estimates have been based on carcass survey recoveries summarized in the annual WDFW spawning ground survey reports. Prior to 1995 age composition estimates were based on returns to the Leavenworth hatchery facility in Icicle Creek and on samples of sport catch of wild fish (Beamesderfer, et al., 1997). Estimates of the annual number of spawners are derived from the redd count data by applying a standard expansion factor (2.2 fish per redd) based on an average ratio of redd counts above the Chiwawa River weir to direct estimates of the number of spring chinook passing the weir site (Beamesderfer et al., 1997).

Recent year natural spawners include returns originating from naturally spawning parents, strays from the Leavenworth Hatchery program in Icicle Creek and returns from a directed supplementation program (primarily from Chiwawa River releases). The most recent 10 year average contribution of naturally produced returns on the spawning grounds has been 62% (Table 2), ranging from 35% to 92%.

Abundance in recent years has been highly variable; the most recent 12-year geomean number of natural origin spawners was 226. During the period 1960-1999, returns per spawner for spring chinook in the Wenatchee subbasin ranged from 0.06 to 4.59. The most recent 20-year (1979-1998) geometric mean of returns per spawner, adjusted for marine survival and delimited at 75% of the size threshold for this population was 0.74 (Table 2).

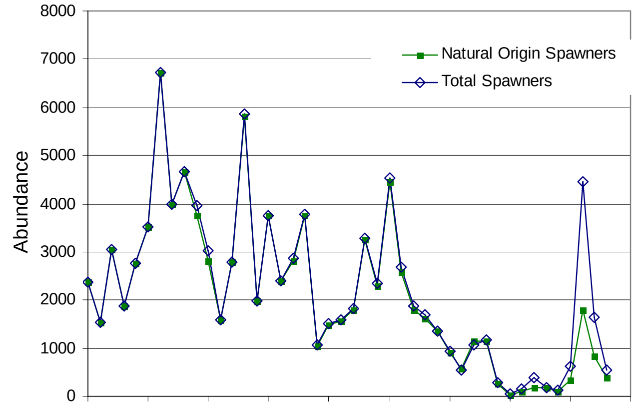

Figure 2. Wenatchee River Spring Chinook Salmon population spawner abundance estimates (1960 to 2003).

Table 2. Wenatchee River Spring Chinook Salmon population abundance and productivity estimates.

10-year geomean natural abundance	226
20-year return/spawner productivity	0.73
20-year return/spawner productivity, SAR adj. and delimited[a]	0.74
20-year Bev-Holt fit productivity, SAR adjusted	1.14
Lambda productivity estimate	1.01
Average proportion natural origin spawners (recent 10 years)	62%
Reproductive success adj. for hatchery origin spawners	No data available

[a]Delimited productivity excludes any spawner/return pair where the spawner number exceeds 75% of the size threshold for this population. This approach attempts to remove density dependence effects that may influence the productivity estimate.

Comparison to Viability Curve

Abundance: 10-year geomean Natural Origin Returns
Productivity: 20-year geomean R/S, SAR adjusted and delimited at 75% of the threshold
Curve: Hockey-Stick curve
Conclusion: Wenatchee Spring Chinook population is at **HIGH RISK** based on current abundance and productivity. The point estimate for abundance and productivity is below the 25% risk curve.

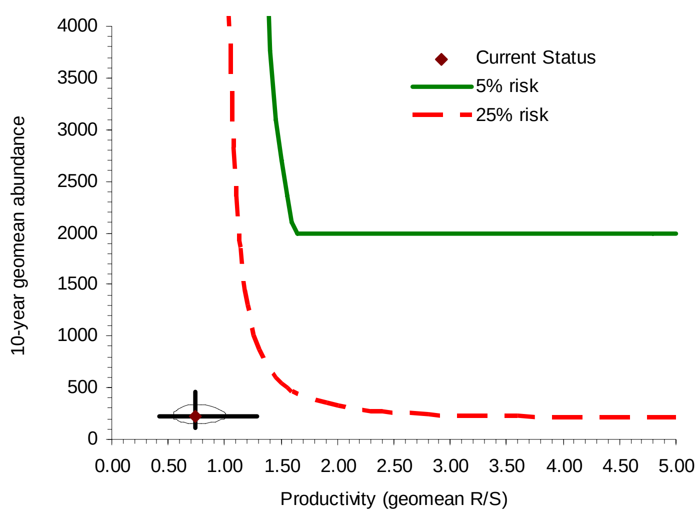

Figure 3. Wenatchee River Spring Chinook Salmon population abundance and productivity compared to the viability curve for this ESU. The point estimate includes a 1 SE ellipse and 95% CI (1.81 X SE abundance line, and 1.80 X SE productivity line).

Spatial Structure and Diversity

The ICTRT has identified five historical major spawning areas (MaSAs) and four minor spawning areas (MiSAs) within the Wenatchee population (Figure 4). The five MaSAs are: Chiwawa, Nason Cr., Little Wenatchee R., White River and the upper Wenatchee mainstem (Tumwater Canyon to Lake Wenatchee). The minor spawning areas (MiSAs) estimated from the intrinsic potential analysis include Icicle, Chumstick, Peshastin, and Mission Creeks.

Currently, the primary spawning areas used by spring Chinook in the Wenatchee are the Chiwawa River, Nason Creek, White River, the Little Wenatchee River and the mainstem Wenatchee between Tumwater Canyon and Lake Wenatchee (Salmonscape 2003; Tonseth 2003). Icicle Creek consistently has unlisted Carson stock spring Chinook spawning below the Leavenworth National Fish Hatchery and, beginning in 2001, Carson stock hatchery spring Chinook have been planted in Peshastin Creek. Redds in these drainages would not contribute to VSP parameters because almost no wild Wenatchee origin fish are known to spawn in these MiSAs. During high abundance years, such as 2001, spring Chinook were also observed in Chiwaukum Creek (A. Murdoch, personal communication).

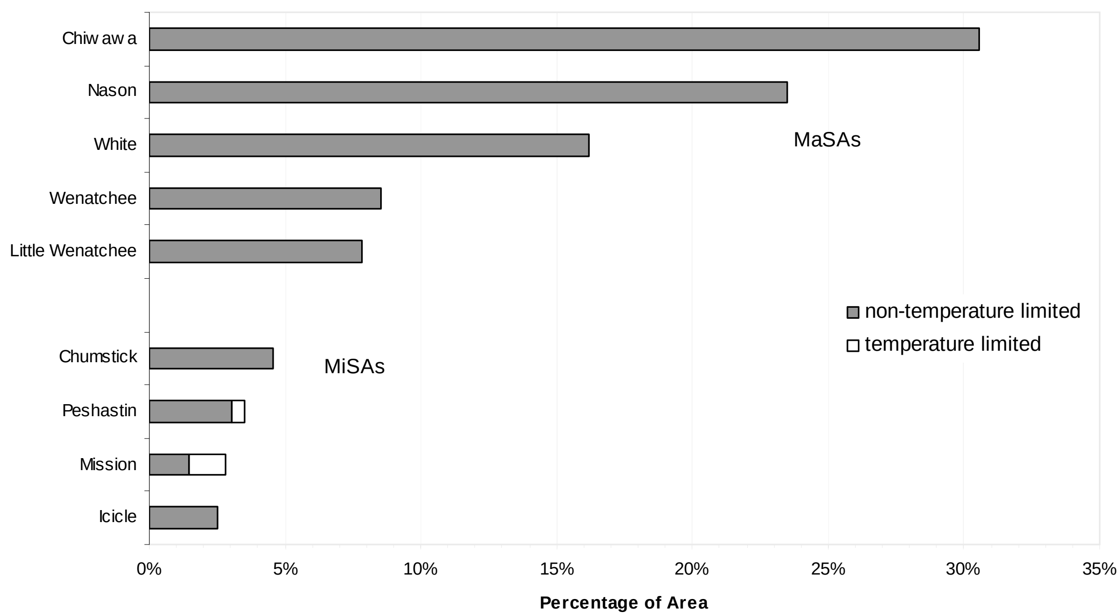

Figure 4. Wenatchee River Spring Chinook Salmon population distribution of intrinsic potential habitat across major and minor spawning areas. White bars represent current temperature limited areas that could potentially have had historical temperature limitations.

Factors and Metrics

A.1.a Number and spatial arrangement of spawning areas

The Wenatchee spring Chinook population has five MaSAs (Chiwawa, Nason, White, and Little Wenatchee, and Upper Wenatchee mainstem) and they are all currently occupied (based on agency defined distribution) so it is at *very low risk*.

A.l.b. Spatial extent or range of population

The Wenatchee spring Chinook population has five MaSAs (Chiwawa, Nason, White, and Little Wenatchee, and Upper Wenatchee mainstem) and they are all occupied (based on agency defined distribution) so it is at *very low risk*. Additionally, based on redd counts in index areas from the most recent brood cycle (2000-2004) and during the last 3 brood cycles, the Wenatchee population would also be at very low risk. However, there were some years during the last 3 brood cycles that did not meet minimum occupancy requirements in the White, Little Wenatchee, and Upper Wenatchee mainstem MaSAs.

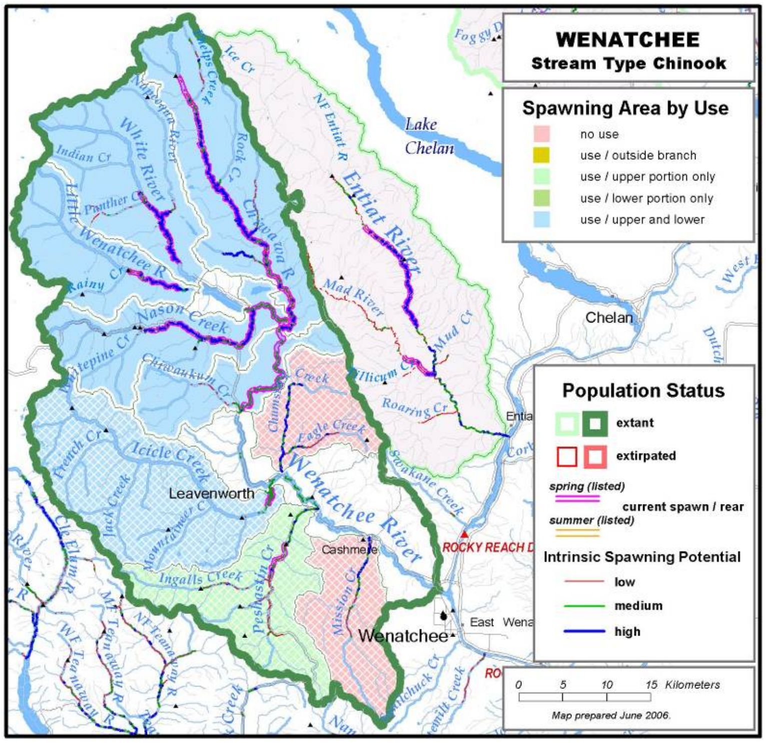

Figure 5. Wenatchee River Spring Chinook Salmon population current spawning distribution and spawning area occupancy designations.

A.1.c. Increase or decrease in gaps or continuities between spawning areas

There has been no increase or decrease in gaps between MaSAs for the Wenatchee spring Chinook population, however the loss of multiple MiSAs at the lower end of the population boundary (below Tumwater Canyon) puts the population at *moderate risk* for this metric. It is assumed that habitat conditions, primarily flow and barriers prohibit the use of Mission and Chumstick Creeks as minor spawning areas. There is considerable uncertainty regarding the ability of these watersheds (Mission and Chumstick) to produce spring Chinook, even under pristine historical conditions. Additionally, there is uncertainty regarding passage of spring Chinook at the Boulder field in Icicle Creek. The opinion of local biologists is that the boulder field always was a barrier (even though road debris has made it artificially enhanced) and recent studies using marked hatchery fish from the LNFH (Cappellini 2001), and historical information from the Wenatchi tribe support that assumption.

B.1.a. Major life history strategies

The Wenatchee spring Chinook population is *very low risk*, because no major life history strategies have been lost.

Studies of juvenile rearing and migration have identified three major juvenile life history patterns within the Wenatchee spring chinook population: summer and overwinter rearing within natal spawning areas, fall presmolt migration and overwintering in the mainstem Wenatchee downstream of natal tributaries, and early summer emigration to downstream areas for summer rearing and overwintering. Limited PIT tagging information indicates that emigrating parr and presmolts use the mainstem reaches above Tumwater Dam for subsequent rearing.

B.1.b. Phenotypic variation

We do not have data available for this metric. Even if we determined that there was a change to one or more traits we do not know what the exact baseline is because changes likely occurred before there was biological monitoring. Therefore, we will assume that there has been some change and increase in variance for 2 or more traits placing the population at *moderate risk*.

B.1.c. Genetic variation

The Wenatchee spring Chinook population was determined to be at *high risk* for genetic variation due to a persistent homogenization from previous fish management efforts. Analyses based on allozymes collected in the 1980s suggest that there was some differentiation between subpopulations consistent with the level of differentiation expected in that time frame, particularly in the White and Twisp drainages. However, microsatellite samples collected in the late 1990s and early 2000s do not show this same differentiation, suggesting that recent management practices and the sequence of extremely low annual spawning numbers in the mid 1990s may have disrupted natural gene flow (ICTRT pop id draft, in prep), A third study (Murdoch et al. date), also analyzed by the ICTRT, includes samples only from the Wenatchee River and indicates that there is some differentiation between watersheds Nason Creek, White River, and Chiwawa River samples. The subgroup concluded that the overall Wenatchee population has been homogenized with other UC populations due to past practices. Their conclusion was based on high similarity to all UC hatchery samples and AMOVA analysis indicating no apparent structure between populations. However, there is some indication, in both the allozyme data and the more recent microsatellite data that there may be some substructure within the population. Data examined include both allozyme and microsatellite data collected by WDFW and analyzed in Ford et al. (2000), and by the ICTRT genetics subgroup (Analyses to be published, available upon request.). It is possible that the true genetic risk metric for this population is lower. If additional data becomes available indicating differentiation between and within populations (either genetic data indicating levels of divergence consistent with the time since separation; or genetic information showing strong spatial structure), the risk level for this metric could improve to moderate or low risk.

B.2.a. Spawner composition

(1) Out-of-ESU spawners. The Wenatchee spring Chinook population is at *high risk* with respect to this metric due to the presence of non-local (outside the ESU origin) stocks on the spawning grounds, which include both LNFH and other stocks from hatcheries outside the Upper Columbia ESU. Tagging studies indicate that LNFH stray rates are generally low (<1%) (Pastor 2004). However, based on expanded carcass recoveries from spawning ground surveys (2001-2004), LNFH and other out-of-basin spawners have comprised from 3-27% of the spawner composition above Tumwater Canyon (WDFW unpublished data). Its possible that 4 years of data is not sufficient to evaluate this metric and our risk assessment could change with the inclusion of a longer time series of data. It has been suggested that the mark rate and recovery rate for hatchery fish was insufficient to determine spawner composition prior to 2000 (Andrew Murdoch, personal communication). Therefore, continuing a 100% external mark rate of hatchery fish and recovering high proportions of carcasses should be a priority.

(2) Out of MPG spawners. The Upper Columbia ESU only has one extant MPG, so this metric is *not applicable* and no score will be given.

(3) *Out of population spawners*. Out of population (but within MPG) origin spawners comprised 0% and 1.8% of the naturally spawning population in 2001 and 2002, respectively (Tonseth 2003, 2004). Based on this short-term data set, the population was at *low risk* with respect to this metric. However, we recognize that two years is likely not sufficient to assess long-term risk and conclude that more years need to be added to the time series. Additionally, if the rearing and release practices discussed in the next metric are not addressed then all the hatchery fish on the spawning grounds will fall into this category and the population will be at high risk for this metric.

(4) Within-population hatchery spawners . Since 1993, a total of 56% of the spawners in tributaries above Tumwater Canyon have been of local hatchery origin, specifically the Chiwawa supplementation program (WDFW unpublished data). Regardless of the duration (# of generations), this high proportion of hatchery fish on the spawning grounds places the population at *high risk* for this metric. Additionally, the Chiwawa River integrated hatchery program strays to other non-target MaSAs and commonly makes up greater than 10 % of the spawner composition in Nason Creek and the White and Little Wenatchee Rivers, based on comprehensive data collected in 2001 and 2002 (Tonseth 2003; Tonseth 2004).

B.3.a. Distribution of population across habitat types.

The intrinsic potential distribution for Wenatchee spring Chinook covered four ecoregions; however, over 90% of the high to medium rated habitat was in two ecoregion types, Chiwaukum Hills and Lowlands and Wenatchee Chelan Highlands. The loss of occupancy in all four MiSAs below Tumwater Canyon did not eliminate an ecoregion type or shift the distribution of ecoregion types by more than 1/3. Therefore, the population was at *low risk* for this metric.

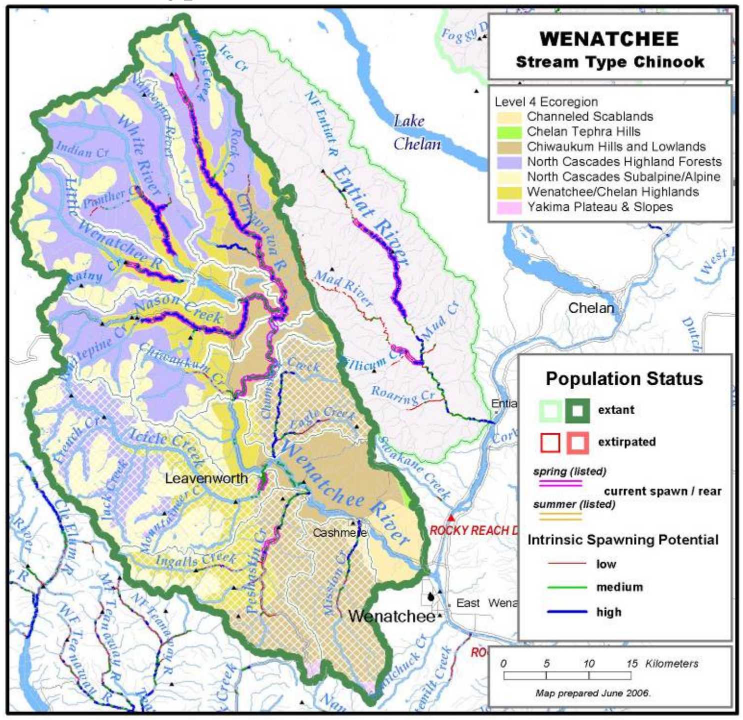

Figure 6. Wenatchee River Spring Chinook Salmon population spawning distribution across EPA level 4 ecoregions.

Table 3. Wenatchee River Spring Chinook Salmon population proportion of current spawning areas across EPA level 4 ecoregions.

Ecoregion	% of historical spawning area in this ecoregion (non-temperature limited)	% of currently occupied spawning area in this ecoregion (non-temperature limited)	% of historical spawning area in this ecoregion (temp. limited)[a]
Channeled Scablands	1.1	0.0	1.1
North Cascades Highland Forests	4.3	3.3	4.3
Wenatchee/Chelan Highlands	41.7	47.6	41.7
Chiwaukum Hills And Lowlands	52.9	49.1	52.9

[a]Temperature limited areas were assessed by subtracting area where the mean weekly modeled water temperature was greater than 22^{o}C.

B.4.a. Selective change in natural processes or selective impacts.

Hydropower system: The hydropower system and associated reservoirs impose some selective mortality on spring Chinook smolt outmigrants, but we assumed negligible effects to upstream migrating adults. Current estimates of project mortality are approximately 2%, but some portion of that 2% is natural mortality, and we assumed that the mortality was not selective against either early or late returning adults. For the smolt effects we assumed that hydro project mortality, reservoir delays, and size selective predation imposed selective mortality against smaller smolts (Baldwin et al. 2003; Fritz and Pearsons 2006). The specific magnitude of selective mortality and the exact proportion of population that is affected are unknown. The duration of the impact was considered long because it is ongoing and has been occurring for multiple generations. We rated the selection intensity as high because the proportion of the population effected was high due to cumulative smolt mortality in the hydrosystem. We rated the heritability as low because smolt size is primarily a function of environmental conditions. The resulting selectivity rating for the hydrosystem was **moderate risk**.

Harvest: Mainstem fishery harvest rates on returning Upper Columbia spring chinook (including the Wenatchee run) have ranged from 3.5% to 14.8% during the period 1980 to 2005, averaging approximately 10% annually (ODFW & WDFW, 2006). Although some harvest may be size selective for larger fish, the selective mortality is assumed to affect less than 2% of the population resulting in a rating of negligible for the proportion affected. There is no in-basin harvest of Wenatchee spring Chinook. Therefore, the harvest selectivity rating was **low risk**.

Hatcheries: The Chiwawa River hatchery program is operated to be non-selective by collecting broodstock so that their run-timing, sex, and age mimic that of the total run at Tumwater Dam (Wenatchee HGMP). This metric was rated at **low risk**.

Habitat: There are two habitat changes that we considered for selective mortality, altered flow profiles and decreased rearing habitat in the lower Wenatchee River mainstem. The timing of altered flow profiles is such that it does not affect run timing for returning adults so it was rated at **low risk**. We also considered the loss of diversity of juvenile life history pathways due to the loss of side channels, riparian condition, and floodplain function in the lower Wenatchee mainstem. A relatively high proportion of subyearling spring Chinook are known to migrate from the tributaries (Chiwawa) in the fall and overwinter in the Upper Wenatchee mainstem and Tumwater Canyon (e.g., Murdoch et al., 1999). It is uncertain weather or not the Lower Wenatchee River downstream of Tumwater Canyon was a historically important winter rearing area. If it was then the selectivity rating for this metric would be moderate or high risk. However, given the uncertainty of the historic utilization of the Lower Wenatchee River we rate this metric at **low risk**.

The overall selectivity rating is **moderate risk**.

Spatial Structure and Diversity Summary

The Wenatchee spring Chinook population was determined to be at low risk for goal A (allowing natural rates and levels of spatially mediated processes) but at high risk for goal B (Maintaining natural levels of variation) resulting in an overall HIGH risk rating. The metrics for genotypic and phenotypic variation were the determining factors for the high risk rating of Wenatchee spring Chinook. We concluded that there was evidence for a high degree of homogenization within the Wenatchee population as well as among the three extant Upper Columbia Spring chinook populations. However, there was considerable uncertainty regarding whether or not the level of divergence in the Wenatchee was sufficient for a moderate risk rating. Therefore continued efforts to maintain natural levels of exchange within and among populations and further evaluation could lead to an improved risk rating. For B.1.b. (phenotypic variation), an analysis needs to be conducted that shows that the phenotypic traits of the current population are consistent with the assumed historical condition or with unaltered reference populations in a similar habitat, geologic, and hydrologic setting. Based on the scoring system, this metric must be addressed in order for the status of goal B to improve to low risk.

There were two metrics that were rated at high risk related to spawner composition that did not directly reduce the overall risk conclusion, but should be considered potential threats to both genotypic (B.1.3) and phenotypic variation (B.1.b). First, Chiwawa River hatchery fish (local origin stock; B.2.a.2) comprise a large portion of the fish on the spawning grounds over multiple generations. Additionally, this hatchery operation is not meeting best management practices because the rearing and release strategies (acclimation of Chiwawa fish on Wenatchee River water over the winter) increase the probability of straying to non-target MaSAs. Second, the high proportion (3-27 %) of LNFH fish (out-of-ESU stock) on the spawning grounds poses an additional risk to genotypic and phenotypic variation. However, due to the scoring system these high-risk ratings were averaged with other metrics and did not directly cause an increased risk rating.

Table 4. Wenatchee River Spring Chinook Salmon population spatial structure and diversity risk rating summary.

Metric	Risk Assessment Scores				
	Metric	Factor	Mechanism	Goal	Population
A.1.a	VL (2)	VL (2)	Mean = 1.33 Low Risk	Low Risk	**High Risk**
A.1.b	VL (2)	VL (2)			
A.1.c	M (0)	M (0)			
B.1.a	VL (2)	VL (2)	High Risk (-1)	High Risk	
B.1.b	M (0)	M (0)			
B.1.c	H (-1)	H (-1)			
B.2.a(1)	H (-1)	H (-1)	High Risk (-1)		
B.2.a(2)	NA				
B.2.a(3)	L (1)				
B.2.a(4)	H (-1)				
B.3.a	L (1)	L (1)	Low Risk (1)		
B.4.a	M (0)	M (0)	Moderate Risk (0)		

Overall Risk Rating:

The Wenatchee spring Chinook population is not currently meeting viability criteria. Of particular concern is the high risk rating with respect to abundance and productivity. The population cannot achieve any level of viability without improving its status on the viability curve for both abundance and productivity. Spatial structure and diversity was also rated at high risk, due primarily to a high level of genetic homogenization within and among populations. Improvement of the spatial structure and diversity status to low risk would be required to allow the Wenatchee population to achieve a “highly viable” status (in addition to the improvements needed for abundance and productivity). Based on the MPG guidelines, the Wenatchee population will need to achieve a highly viable status for recovery of the ESU (ICTRT 2005).

		Spatial Structure/Diversity Risk			
		Very Low	**Low**	**Moderate**	**High**
Abundance/ Productivity Risk	**Very Low** (<1%)	**HV**	**HV**	**V**	M*
	Low (1-5%)	**V**	**V**	**V**	M*
	Moderate (6 – 25%)	M*	M*	M*	
	High (>25%)				Wenatchee

Figure 7. Wenatchee River Spring Chinook Salmon risk ratings integrated across the four viable salmonid population (VSP) metrics. *Viability Key: HV – Highly Viable; V – Viable; M* – Candidate for Maintained; Shaded cells – does not meet viability criteria (darkest cells are at highest risk).*

Wenatchee River Spring Chinook Salmon – Data Summary

Data type: Redd count expansions (Wenatchee Spring Chinook without Icicle Creek). Natural returns include wild origin spawners removed as broodstock for short-term supplementation actions.

SAR: Expanded Chiwawa SAR index

Table 5. Wenatchee River Spring Chinook Salmon population abundance and productivity data used for curve fits and R/S analysis. Bolded values were used in estimating the current productivity (Table 6).

Brood Year	Spawners	%Wild	Natural Run	Nat. Rtns	R/S	SAR Adj. Factor	Adj. Rtns	adj R/S
1979	**1063**	**0.98**	**1039**	**1406**	**1.32**	**1.32**	**1859**	**1.75**
1980	1519	0.98	1486	3025	1.99	0.80	2408	1.58
1981	1595	0.98	1566	4045	2.54	0.74	2977	1.87
1982	1819	0.98	1786	2873	1.58	0.72	2062	1.13
1983	3286	0.99	3249	1693	0.52	0.80	1358	0.41
1984	2341	0.98	2295	1105	0.47	1.36	1506	0.64
1985	4529	0.98	4445	1380	0.30	1.34	1846	0.41
1986	2674	0.97	2582	886	0.33	1.80	1597	0.60
1987	1878	0.96	1803	1065	0.57	1.48	1575	0.84
1988	1692	0.96	1625	696	0.41	0.73	505	0.30
1989	**1349**	**0.96**	**1347**	**829**	**0.61**	**1.27**	**1054**	**0.78**
1990	**927**	**0.95**	**899**	**183**	**0.20**	**3.12**	**572**	**0.62**
1991	**552**	**1.00**	**582**	**122**	**0.22**	**7.30**	**890**	**1.61**
1992	**1080**	**0.98**	**1140**	**70**	**0.06**	**5.21**	**364**	**0.34**
1993	**1179**	**0.89**	**1146**	**124**	**0.11**	**0.49**	**61**	**0.05**
1994	**275**	**0.89**	**255**	**205**	**0.75**	**1.92**	**394**	**1.43**
1995	**51**	**0.35**	**18**	**229**	**4.53**	**0.41**	**95**	**1.88**
1996	**158**	**0.64**	**109**	**506**	**3.20**	**0.37**	**189**	**1.19**
1997	**385**	**0.40**	**188**	**1768**	**4.59**	**0.15**	**264**	**0.69**
1998	**183**	**0.88**	**174**	**686**	**3.76**	**0.19**	**132**	**0.72**
1999	119	0.92	109					1.75
2000	620	0.55	351					
2001	4446	0.38	1798					
2002	1651	0.51	842					
2003	539	0.71	383					

Table 6. Wenatchee River Spring Chinook Salmon population geometric mean abundance and productivity estimates (values used for current productivity and abundance are shown in boxes).

	R/S measures				Lambda measures		Abundance
	Not adjusted		SAR adjusted		Not adjusted		Nat. origin
delimited	median	75% threshold	median	75% threshold	1987-1998	1979-1998	geomean
Point Est.	0.77	0.75	0.74	$\boxed{0.74}$	1.02	1.01	$\boxed{226}$
Std. Err.	0.52	0.47	0.34	0.31	0.65	0.40	0.40
count	10	11	10	11	12	20	10

Table 7. Wenatchee River Spring Chinook Salmon population stock-recruitment curve fit parameter estimates. Biologically unrealistic or highly uncertain values are highlighted in grey.

	Not adjusted for SAR							Adjusted for SAR						
SR Model	a	SE	b	SE	adj. var	auto	AICc	a	SE	b	SE	adj. var	auto	AICc
Rand-Walk	0.73	0.20	n/a	n/a	0.60	0.77	69.6	0.73	0.14	n/a	n/a	0.67	0.16	54.1
Const. Rec	675	173	n/a	n/a	n/a	n/a	66.9	675	171	n/a	n/a	n/a	n/a	66.3
Bev-Holt	3.49	3.58	1001	449	0.38	0.82	67.4	1.14	0.44	2650	1929	0.59	0.23	54.7
Hock-Stk	2.52	1.39	314	193	0.42	0.82	68.9	0.73	0.13	8959	0	0.67	0.16	56.8
Ricker	1.30	0.54	0.00040	0.00023	0.50	0.79	69.5	1.02	0.29	0.00023	0.00016	0.60	0.21	54.9

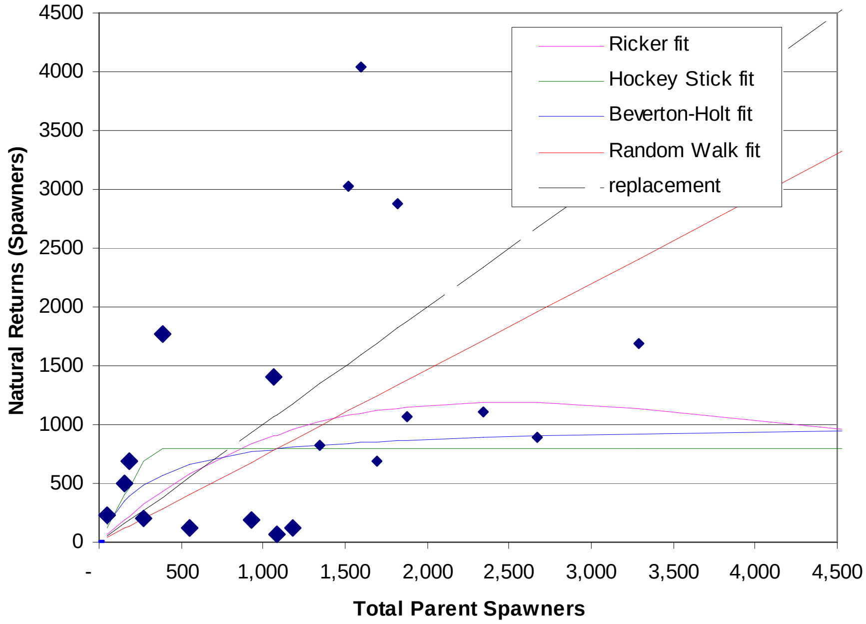

Figure 8. Wenatchee River Spring Chinook Salmon population stock recruitment curves. Bold points were used in estimating the current productivity. Data were not adjusted for marine survival.

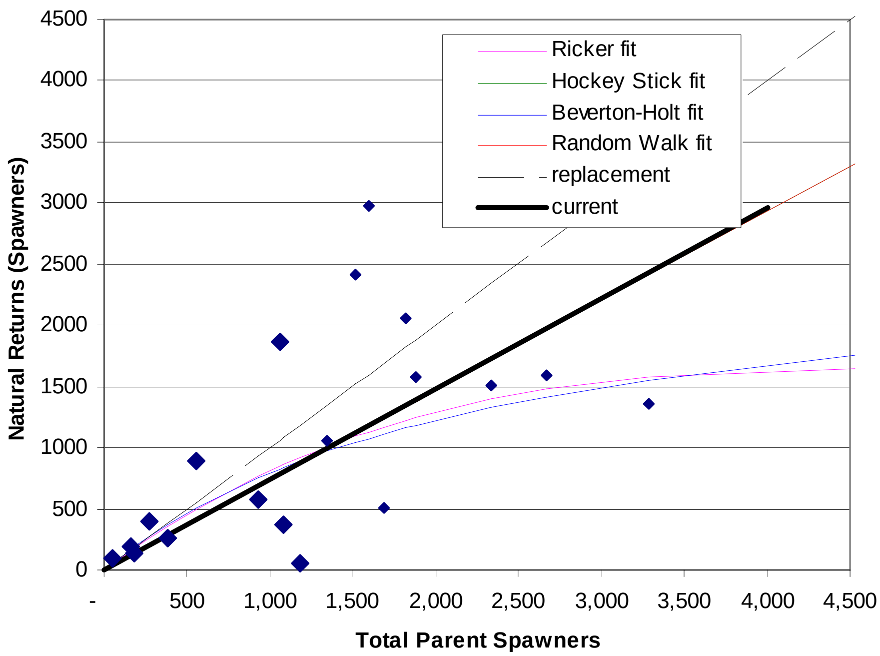

Figure 9. Wenatchee River Spring Chinook Salmon population stock recruitment curves. Bold points were used in estimating the current productivity. Data were adjusted for marine survival.

Literature Cited

Baldwin, C. M., J. G. McLellan, M. C. Polacek, and K. Underwood. 2003. Walleye predation on hatchery releases of kokanees and rainbow trout in Lake Roosevelt, Washington. North American Journal of Fisheries Management 23: 660-676.

Beamesderfer, R. C. P., H. P. Schaller, M. P. Zimmerman, C. E. Petrosky, O. P. Langness, and L. LaVoy. 1997. Spawner-recruit data for spring and summer Chinook salmon populations in Idaho, Oregon, and Washington. Unpublished draft manuscript dated 23 June 1997, 78 p

Cappellini, M. J. 2001. Movements of bull trout (*Salvelinus confluentus*), spring chinook (*Oncorhynchus tshawytscha*), and steelhead (*Oncorhynchus mykiss*) in Icicle Creek, Washington. United States Fish and Wildlife Service, Leavenworth, Washington.

Fritz, A. L. and T. N. Pearsons. 2006. Effects of predation by nonnative smallmouth bass on native salmonid prey: the role of predator and prey size. Transactions of the American Fisheries Society 135:853-860.

ICTRT, 2003. Independent Populations of chinook, steelhead and sockeye for listed Interior Columbia Basin ESUs. Draft. Interior Columbia Basin Technical Recovery Team Report. July, 2003

ICTRT. 2005. Viability Criteria for application to interior Columbia basin ESUs. Interior Columbia Basin Technical Recovery Teamdraft Report. 49 pp.

Mosey, T.R. and L.J. Murphy. 2002. Spring and summer chinook spawning ground surveys on the Wenatchee River basin, 2001. Chelan County Public Utility Dist. 35 p + appendices

Murdoch, A, K. Petersen, T. Miller, M. Tonseth and T. Randolph. 1999. Freshwater production and emigration of juvenile spring chinook salmon from the Chiwawa River in 1998. Washington Dept. of Fish and Wildlife Report. Prepared for Public Utility Dist. #1 of Chelan County. Rept. # SS99-05. 57 p.

NPPC 2004. Wenatchee Subbasin Plan. http://www.nwcouncil.org/fw/subbasinplanning/wenatchee/plan. Portland, Oregon.

Pastor, S. M. 2004. An evaluation of fresh water recoveries of fish released from National Fish Hatcheries in the Columbia River Basin, and observations of straying. American Fisheries Society Symposium XX:xxx-xxx. Bethesda, Maryland.

Oregon Dept. of Fish and Wildlife, Washington Dept. of Fish and Wildlife. 2006. Joint staff report concerning commercial seasons fro spring chinook, steelhead, sturgeon, shad, smelt, and other species and miscellaneous regulations for 2006. Jan. 18,2006.

Salmonscape. 2003. Salmonid Fish Distribution - salmonscape.fishdist. Available from Washington Department of Fish and Wildlife. http://wdfw.wa.gov/mapping/salmonscape/ Olympia, Washington.

Tonseth, M. 2003. 2001 Upper Columbia River stock summary for sockeye, spring Chinook, and summer Chinook. A technical memo to "distribution list", from the Washington Department of Fish and Wildlife dated January 15, 2003. Wenatchee, Washington

Tonseth, M. 2004. 2002. Upper Columbia River stock summary for sockeye, spring Chinook, and summer Chinook. A technical memo to "distribution list", from the Washington Department of Fish and Wildlife dated August 31, 2004. Wenatchee, Washington.

UCSRB. 2006. Draft Upper Columbia Spring Chinook Salmon, Steelhead, and Bull Trout Recovery Plan. Prepared for the Washington State Governors Salmon Recovery Office by the Upper Columbia Salmon Recovery Board. Available online: http://okanogancounty.org/water/salmon%20recovery;%20draft%20review%20corner.htm

Umatilla River Summer Steelhead Population
Current Status Assessment

The Umatilla River Summer Steelhead population (Figure 1) is part of the Mid-Columbia Steelhead DPS which has four major population groupings (MPG): Cascades Eastern Slope Tributaries, John Day River, Umatilla/Walla Walla Rivers, and the Yakima River group. There are three life history categories in the DPS: summer run, winter run, and summer-winter run combination. The Umatilla River population is a summer run and resides in the Umatilla/Walla Walla Rivers MPG along with the Walla Walla River and Touchet River populations.

The ICTRT classified the Umatilla River population as a “large” sized population (Table 1). A steelhead population classified as large has a mean minimum abundance threshold of 1,500 with sufficient intrinsic productivity (greater than 1.26 recruits per spawner at the minimum abundance threshold) to achieve a 5% or less risk of extinction over a 100-year timeframe.

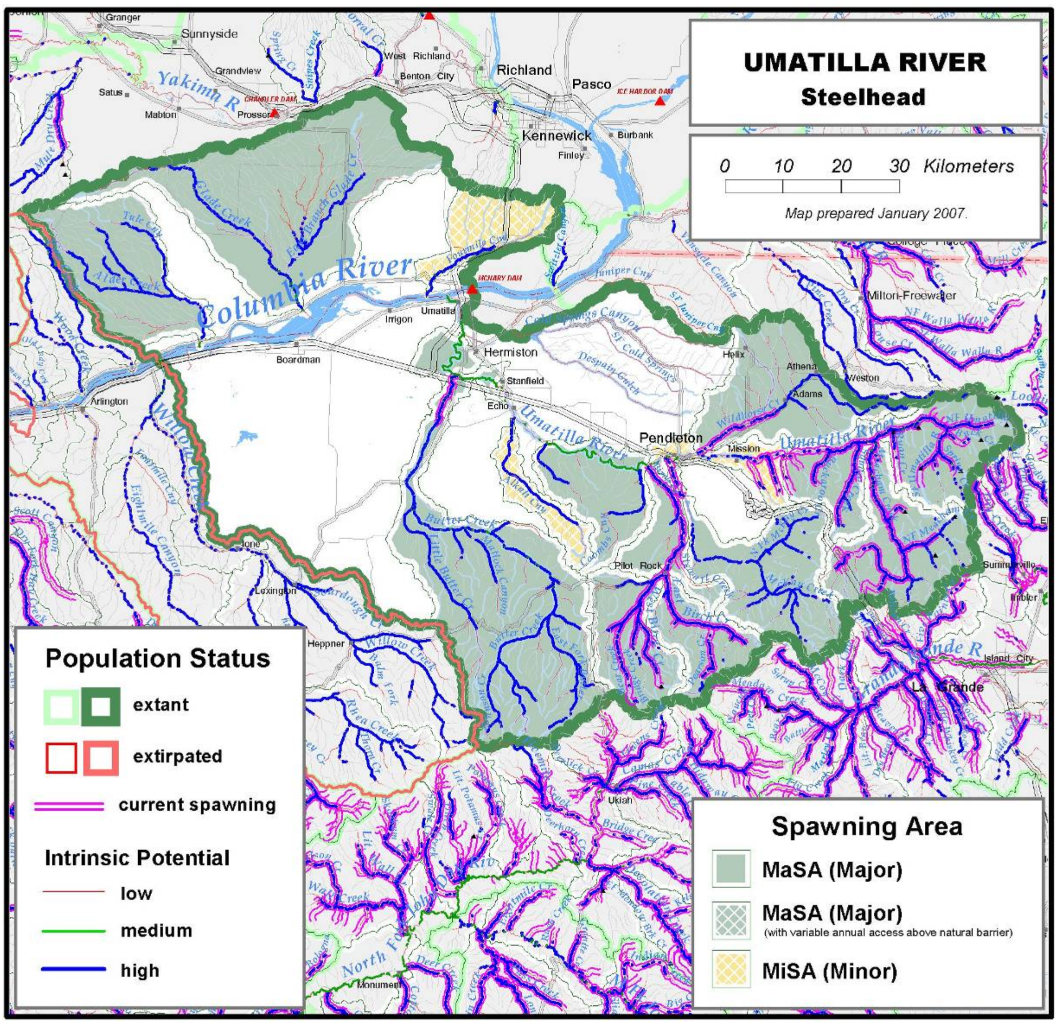

Figure1. Umatilla River Summer Steelhead population boundary and major (MaSA) and minor (MiSA) spawning areas.

Table 1. Umatilla River Summer Steelhead basin statistics and intrinsic potential analysis summary.

Drainage Area (km2)	10,457
Stream lengths km[a] (total)	2,322
Stream lengths km[a] (below natural barriers)	2,278
Branched stream area weighted by intrinsic potential (km2)	7.531
Branched stream area km2 (weighted and temp. limited[b])	7.456
Total stream area weighted by intrinsic potential (km2)	9.070
Total stream area weighted by intrinsic potential (km2) temp limited[b]	3.415
Size / Complexity category	Large / B (dendritic structure)
Number of Major Spawning Areas	13
Number of Minor Spawning Areas	3

[a]All stream segments greater than or equal to 3.8m bankfull width were included

[b]Temperature limited areas were assessed by subtracting area where the mean weekly modeled water temperature was greater than 22°C.

Current Abundance and Productivity

Current (1967 to 2004) total abundance (number of adult spawners in natural production areas) has ranged from 771 (1998) to 5,172 (2002) (Figure 2). Spawner abundance estimates for natural and hatchery summer steelhead in the entire Umatilla River Basin were determined from complete counts of adult returns to Three Mile Falls Dam (TMFD) at river mile 3.7 minus removals or mortality at and above the dam in all years except brood years (BY) 1984-1987. Fish were enumerated using electronic counters from BY 1967-1983, trapping from BY 1988-2000, and a combination of trapping and video monitoring from BY 2001-present. For BYs 1984-1987 abundance estimates were made with mark-recapture estimates. Missing abundance data for BY 1971, 1972, and 1979 were reconstructed using the known mean brood age structure from BY 1991-1998 and all available counts of brood returns in years before and after the missing counts. Counts in BY 1976 and 1978 were also incomplete but not reconstructed. In these years, electronic counters only operated from Dec 24 – May 31 and Dec 13 – Mar 9, respectively. Age structure was determined by reading about 100-150 scales per year collected from adults returning in BY 1994-2004. Missing run year age structure data before BY 1994 was estimated as the BY 1994-2004 mean age structure.

Several sets of missing data for removals and mortalities at and above TMFD were estimated from the best available data. Missing harvest removals were estimated from creel survey data collected from the non-tribal fishery from BY 1993-2004 and the tribal fishery from BY 1993-2001. Harvest of hatchery fish from BY 1988-1992 was estimated as the mean percent harvest of the hatchery run passed above TMFD from the later time period (2.5% non-tribal and 6.4% tribal). All harvested fish were assumed to be natural origin before BY 1988. For years when harvest of natural fish was allowed in the non-tribal fishery (before BY 93), harvest was estimated as mean percent catch of the natural run passed above TMFD (6.8 %) (1993-2004) corrected by the mean percent of catch released (26%). Tribal harvest for BYs 1967-1987 of hatchery and natural steelhead was estimated as their respective mean percent harvest of their runs passed above TMFD (6.7% of the combined natural and hatchery run passed above TMFD). Missing broodstock removals in BY 1981 and 1982 were estimated as one natural fish collected for brood per 750 smolts produced based on the ratio of brood collected and smolts released in the early 1980's. All 95 hatchery fish collected for brood in BY 1991 were assumed to be coded-wire tagged and included in the total removal of 124 hatchery fish at TMFD for coded-wire tag recovery.

Recent year natural spawners include returns originating from naturally spawning parents, Umatilla River hatchery origin fish and out-of-DPS spawners, primarily from the Snake River Basin. Natural origin fish have comprised an average of 73% of natural spawners since hatchery returns have been documented in 1988. Since that time, the percentage of natural origin spawners has ranged from 41% to 96%.

Abundance in recent years has been moderately variable, the most recent 10-year geomean number of natural origin spawners was 1,472 (2,347 total spawners). During the period 1967-2000, returns per spawner for steelhead in the Umatilla River ranged from 0.3 (1978) to 4.98 (1998). The most recent 20-year (1981-2000) geometric mean of returns per spawner SAR adjusted and delimited at 75% of the threshold was 1.50 (Table 2).

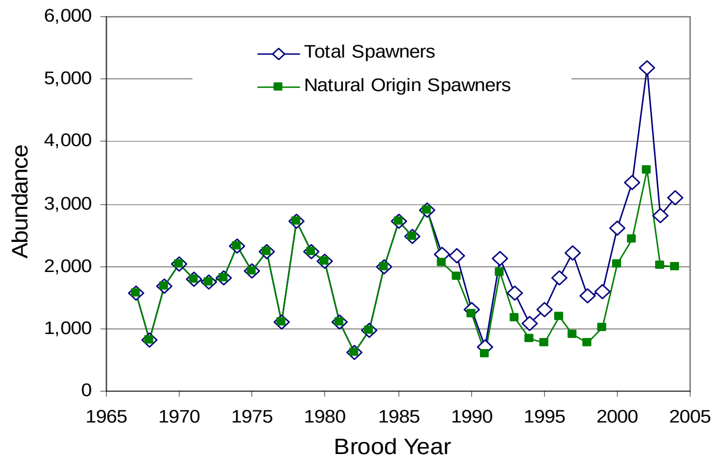

Figure 2. Umatilla River Summer Steelhead population spawner abundance estimates (1967-2004).

Table 2. Umatilla River Summer Steelhead population abundance and productivity measures.

10-year geomean natural abundance	1472
20-year return/spawner productivity	0.94
20-year return/spawner productivity, SAR adj. and delimited[a]	1.50
20-year Bev-Holt fit productivity, SAR adjusted	n/a
Lambda productivity estimate	1.06
Average proportion natural origin spawners (recent 10 years)	0.73
Reproductive success adj. for hatchery origin spawners	n/a

[a]Delimited productivity excludes any spawner/return pair where the spawner number exceeds 75% of the threshold. This approach attempts to remove density dependence effects that may influence the productivity estimate.

Comparison to the Viability Curve

- Abundance: 10-year geomean Natural Origin Returns
- Productivity: 20-yr geomean R/S (adjusted for marine survival and delimited at 1,125 spawners)
- Curve: Hockey-Stick curve
- Conclusion: Umatilla Summer Steelhead population is at MODERATE RISK. The productivity is at low risk because the point estimate is above 5% risk level and the adjusted standard error is above the 25% risk level. Abundance is moderate because the point estimate is slightly below the 5% risk level (Figure 3).

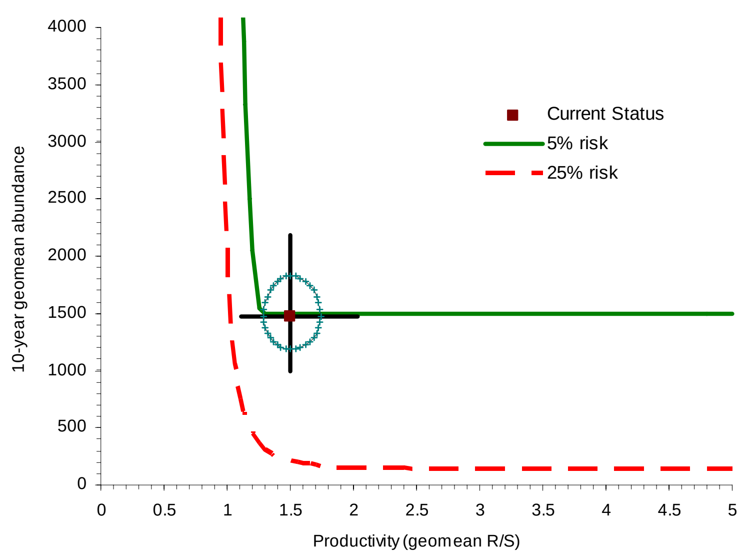

Figure 3. Umatilla River Summer Steelhead current estimate of abundance and productivity compared to the viability curve for this ESU. The point estimate includes a 1 SE ellipse and 95% CI (1.81 X SE abundance line, and 2.02 productivity line).

Spatial Structure and Diversity

The ICTRT has identified 13 historic major spawning areas (MaSAs) and three minor spawning areas (MiSAs) within the Umatilla River steelhead population. In addition, two MaSAs (Alder Creek and Glade Creek) and one MiSA (Fourmile Canyon) were included in the Umatilla River population that are direct tributaries to the Columbia River on the Washington side of the Columbia. We do consider these areas in the assessment of spatial structure/diversity for the Umatilla steelhead population (Figure 4). Current spawning distribution is somewhat limited relative to historic and is concentrated in Birch Creek, Iskulpa Creek, Meacham Creek, Upper Umatilla River, and the North and South Forks of the Umatilla River. There is documented recent year spawning in both Glade Creek and Alder Creek subbasins (Yakama Indian Nation Fisheries Program, 2005).

Spawners within the Umatilla River population include natural-origin returns, hatchery returns of Umatilla River origin broodstock, and hatchery strays, primarily originating from the Snake River Basin. Hatchery-origin fish comprise a significant proportion of the natural spawning fish in most recent years.

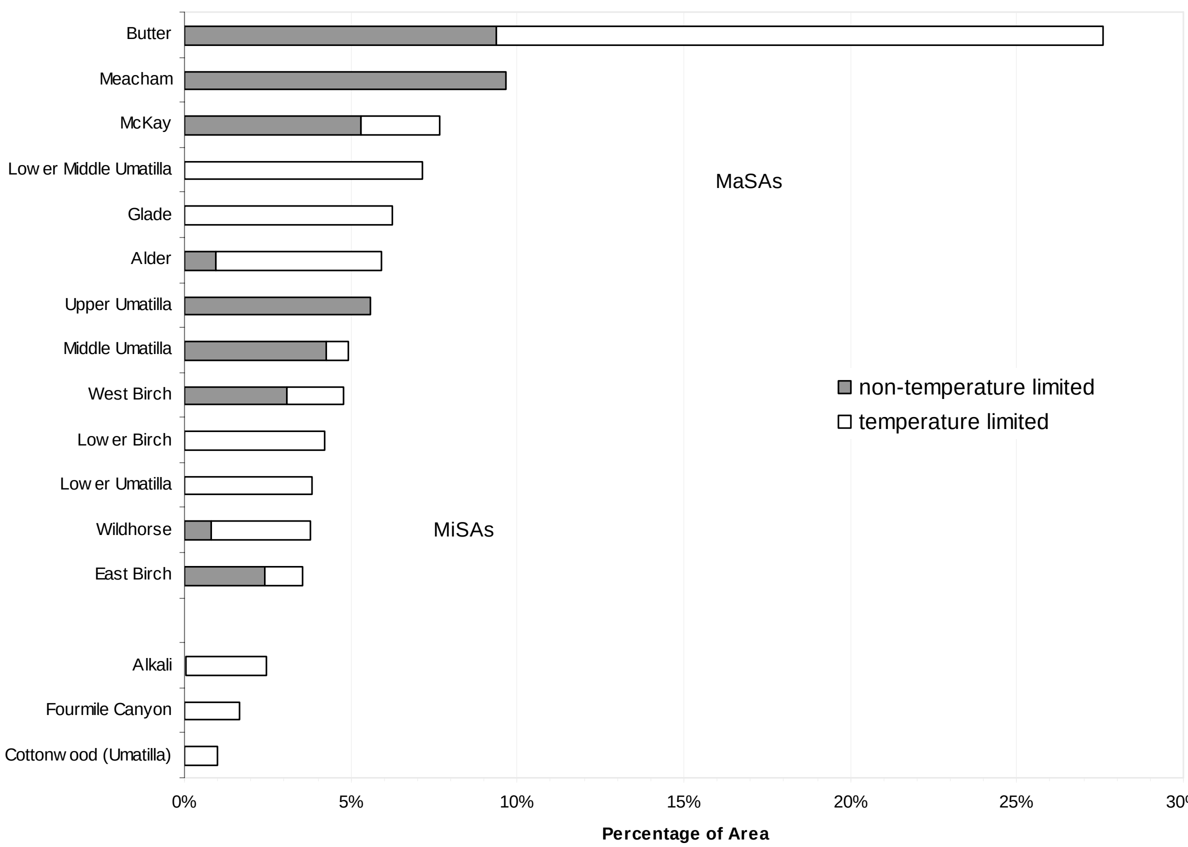

Figure 4. Umatilla River Summer Steelhead distribution of intrinsic potential habitat across major and minor spawning areas. White bars represent current temperature limited areas that could potentially have had historical temperature limitations.

Factors and Metrics

A.1.a. Number and spatial arrangement of spawning areas.

The Umatilla River population has 13 MaSAs and three MiSAs which are distributed in a complex dendritic pattern. Historically the major production areas included Butter Creek, Meacham Creek, McKay Creek, Iskulpa Creek, Birch Creek, and the middle and upper Umatilla River. Spawning distribution has been reduced significantly from the intrinsic historic distribution. Currently eight of the 13 MaSAs are occupied. Alder Creek, Glade Creek, Lower Umatilla, Lower Middle Umatilla, and McKay MaSAs are unoccupied. One of the three MiSAs is currently occupied (Cottonwood Creek). Although there has been a significant reduction in spawner distribution, the Umatilla population rates at **very low risk** because it has more than four occupied MaSAs in a dendritic configuration.

A.l.b. Spatial extent or range of population.

The current spawner distribution is reduced substantially from the intrinsic distribution. Based on the ODFW spawner database and WDFW information, eight of 13 (61.5%) MaSAs are currently occupied and only one of the three MiSAs is occupied (Figure 5). The spatial extent and range of spawning distribution has been reduced to an extent that this population rates as **moderate risk** for this metric. There are 12 index area spawning survey sites in the Umatilla population. Recent survey results will be analyzed for use in future viability assessments.

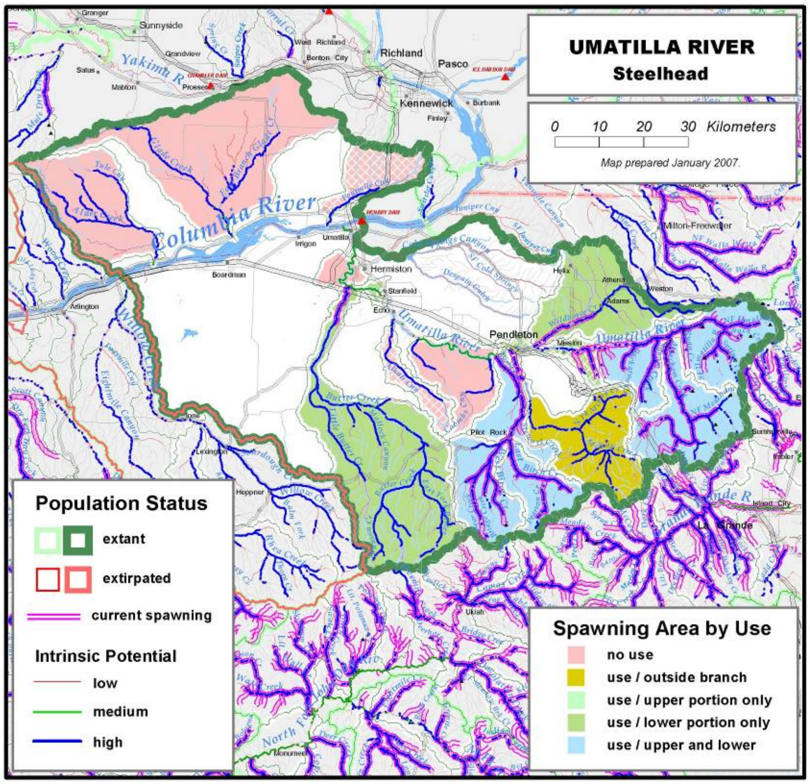

Figure 5. Umatilla River Summer Steelhead population current spawning distribution and spawning area occupancy designations.

A.1.c. Increase or decrease in gaps or continuities between spawning aggregates.

There has been a change in gaps and continuity as a result of the loss of spawning in the McKay Creek and Lower Middle Umatilla River drainages as well as very limited production in the lower portion of the Butter Creek MaSA. Although some spawning occurs in lower Butter Creek, habitat conditions are such that no significant sustained production occurs. Due to the low level of production in Butter Creek it does not serve any connectivity role within or between populations. In addition, less that 75% of the intrinsic MaSAs are currently occupied, thus the rating is **moderate risk** for this metric.

B.1.a. Major life history strategies

We have no observational data to allow any direct comparisons of historic and current life history strategies. Therefore we have used EDT analyses and habitat conditions to infer loss of life history strategies. Flow and temperature changes in the Umatilla Basin have limited movement patterns for both juvenile and adult steelhead. Juvenile steelhead cannot move into some mainstem rearing reaches above McKay Creek for over summer rearing due to high temperatures. Adults are unable to enter the Umatilla in early fall in many years because of the lack of flow as well as high water temperatures. Large areas, such as Butter and McKay creeks drainages, no longer support production. Flow enhancement projects have improved conditions for adult fall migration and summer rearing, particularly below McKay Creek. Past habitat changes have undoubtedly reduced diversity in life history pathways. However, it does not appear that any major pathways have been lost, and improved fall flows have provided conditions allowing adult migration throughout the fall season. Umatilla steelhead still exhibit a diverse age structure including multiple ages at smolt migration, multiple years of ocean residence and repeat spawning. The population rated at **moderate risk** because all pathways exist but there has been significant reduction in variability and changes in distribution.

B.1.b. Phenotypic variation.

We have no data to assess loss or substantial change is phenotypic traits, therefore we infer based on habitat changes. The changes in flow patterns and temperature profile within the Umatilla River and the mainstem Columbia River have likely resulted in reduced variation in adult and juvenile migration patterns. Juveniles have a much narrower window to successfully migrate out of the Umatilla in the spring because water temperatures increase earlier than historically. Even though flow enhancement has improved conditions for adult fall migration, the run-timing distribution is likely truncated from historic. Adults cannot enter the river in early fall in some years because of flow and temperature limitations. We have rated the Umatilla population at **moderate risk** because two or more phenotypic traits have changed.

B.1.c. Genetic variation

The genetics data for Umatilla steelhead indicate that there is significant within population variation between Umatilla steelhead and other populations in the MPG (Touchet, Walla Walla). In addition, the within population diversity shows no indication of impairment. The hatchery fish are similar to natural fish as expected, since they are offspring of natural fish. There are out-of-DPS spawners, primarily from Snake River stocks, spawning naturally in the Umatilla Basin. Given the degree of genetic variation the Umatilla population rated at **low risk** for this metric. Given that the genetics samples used in the analyses were collected from the mid-1980s, prior to significant hatchery influence, the genetic analyses needs to be updated with recent samples.

B.2.a. Spawner composition

(1) *Out-of-DPS spawners*. A significant number of out-of-DPS spawners enter the Umatilla River. Estimates of out-of-DPS spawners are based on expanded coded wire tagged recoveries

of hatchery fish at TMFD. From 1993-2004, out-of-DPS spawners have comprised from 1.8-9.7% (mean=4.8%) of the fish that arrived at TMFD. These strays are not selectively removed because they are not distinguishable from Umatilla Hatchery supplementation steelhead. Given the length of time of influence and the hatchery fraction, we have rated the Umatilla population at **moderate risk** for out-of-DPS spawners. This risk rating assumes strays were present at a similar rate for the past three generations.

(2) *Out-of-MPG spawners*. There have been few, if any, out-of-MPG within DPS spawners recovered in the Umatilla Basin, thus the rating is **very low** for this metric.

(3) *Out-of-population within MPG spawners*. There are two out of population within MPG hatchery programs which could provide stray fish to the Umatilla River, Lyons Ferry releases in the Walla Walla, and Touchet River hatchery fish. No strays from these two programs have been observed. The rating is **very low** for this metric.

(4) *Within-population hatchery spawners*. The Umatilla River population is supplemented annually with hatchery fish produced from wild broodstock collected at TMFD. The supplementation program has been ongoing since the late 1980's. Since 1993, Umatilla Hatchery fish have comprised an average of 29.4% of the natural spawning fish. We characterize this program as using best management practices based on the following:

- Most of the broodstock collected annually are wild fish.
- Mating protocols provide for a high number of family groups annually.
- There presently is no culling or grading of parr or smolts.
- Hatchery smolts are released in localized areas of the middle and upper mainstem.
- There does not appear to be any genetic differentiation between hatchery and natural fish.

Given that best practices are used, the average hatchery fraction is 29.4%, and the program has been underway for three generations, the rating is **moderate risk** for within population hatchery fish.

The overall risk rating for B.2.a. “spawner composition” is **high risk** because the out-of-DPS spawners and within-population hatchery proportions were both rated as moderate.

B.3.a. Distribution of population across habitat types

The intrinsic potential distribution encompasses seven ecoregions, four of which account for at least 10% of the distribution (Figure 6). There has been only one significant shift greater than 67% in the ecoregion distribution (Pleistocene Lake Basins). This population rates at **low risk**.

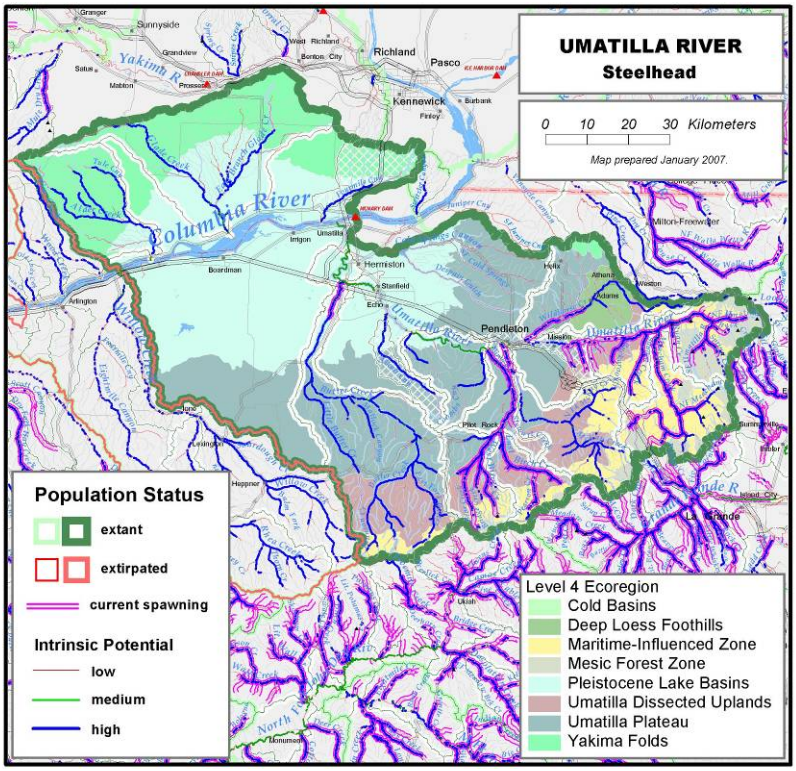

Figure 6. Umatilla River Summer Steelhead population spawning distribution across EPA level 4 ecoregions.

Table 3. Umatilla River Summer Steelhead population proportion of current spawning areas across EPA level 4 ecoregions.

Ecoregion	% of historical spawning area in this ecoregion (non-temperature limited)	% of currently occupied spawning area in this ecoregion (non-temperature limited)
Umatilla Plateau	32.4	27.0
Pleistocene Lake Basins	25.0	6.2
Yakima Folds	5.3	0.0
Deep Loess Foothills	2.7	1.2
Umatilla Dissected Uplands	15.3	19.3
Maritime-influenced Zone	17.7	42.9
Mesic Forest Zone	1.7	3.4

B.4.a. Selective change in natural processes or selective impacts

Hydropower system: The hydropower system and associated reservoirs impose some selective mortality on smolt outmigrants and upstream migrating adults. Selective mortality due to flow and temperature changes influences migration timing. The specific magnitude of selective mortality and the proportion of population that is affected are unknown. For the adult migration timing affects, the duration is multiple generations and the affect is intermittent as it does not occur each year. The proportion of the population affected is low resulting in low strength of selection. We consider adult migration timing to be highly heritable, thus the selective effects on adults are rated moderate risk with low strength of selection and high heritability. For selective mortality on smolt migration timing, the duration is multiple generations with the proportion of population affected low and the heritability low. We rated the smolt migration timing effect as low risk with low selection intensity low heritability. Overall the hydropower selectivity is rated at **moderate risk**.

Harvest: Recent harvest rates for Type-A steelhead in the Columbia River Mainstem are generally less than 10% annually. Although some harvest may be size selective for larger fish, the selective mortality would affect less than 2% of the total population. There is very limited tribal harvest of natural fish within the Umatilla Subbasin and impacts from the recreational fishery are incidental to hatchery fish harvest. There does not appear to be any selective mortality as a result of in-basin harvest. We rated this metric at **very low risk**.

Hatcheries: The Umatilla River summer steelhead hatchery program is operated to provide hatchery fish for harvest and to supplement natural production. Broodstock are collected at TMFD. Typically 100 naturally produced and 20 hatchery fish are collected for broodstock. Broodstock are collected representatively so that their run-timing, sex, and age of broodstock mimic that of the total run at TMFD. We are uncertain of the degree of substructure within the basin or if there are different characteristics between spawning aggregates in the basin. If life history characteristics differ between different aggregates, there is the possibility that collection of broodstock representing TMFD timing may be differentially impacting spawning aggregates. However, the broodstock removal does not appear to be selective at the population level thus we rated this metric at **very low risk**.

Habitat: There are two habitat changes, altered flow profiles and increased temperatures, which likely impose some selective mortality on pre-smolts, smolts, and adults. Mainstem summer temperatures are lethal in many reaches, and juveniles that leave tributary production areas and end up in the mainstem during summer likely suffer increased mortality. The proportion of population affected is low and the heritability is low, thus the juvenile selective impact is rated as low. Temperatures in the Umatilla River often reach stressful levels during the latter part of the smolt outmigration time period. The elevated temperatures likely impose higher mortality on the later migrating smolts. This affect has been ongoing for many generations. The proportion of the population affected is moderate and the heritability is low resulting in an overall rating of low for smolt impacts. Late summer and early fall flows are often low in the Umatilla River and adults entering the river early are likely subject to above normal mortality rates. For adults we rated the intensity of selection as low and the heritability as high resulting in an adult selectivity rating of moderate. The overall rating is **moderate risk** for habitat.

The combined selectivity rating for all four “H”s is **moderate risk**.

Spatial Structure and Diversity Summary

The combined integrated Spatial Structure/Diversity rating is moderate risk (Table 4) for the Umatilla River population. There has been significant reduction in spawner distribution relative to intrinsic potential distribution. This reduction has caused significant increases in gaps between spawning areas as well as disrupted continuity. Habitat changes have been significant in the Umatilla Basin resulting in changes to flow profiles and elevated temperatures. These changes have resulted in impacts to life history diversity and phenotypic trait variation. The out-of-DPS spawners in combination with local origin hatchery fish spawning naturally put the population at high risk for spawner composition. Hydrosystem effects and within basin habitat changes have likely resulted in selective mortality of specific components of juvenile and adult life stages resulting in a moderate risk rating.

Table 4. Umatilla River Summer Steelhead population spatial structure and diversity risk rating summary.

Metric	Risk Assessment Scores				
	Metric	Factor	Mechanism	Goal	Population
A.1.a	L (1)	L (1)	Mean=(0.33) Moderate Risk	Moderate Risk (0.33)	**Moderate Risk**
A.1.b	M (0)	M (0)			
A.1.c	M (0)	M (0)			
B.1.a	M (0)	M (0)	Moderate Risk (0)	Moderate Risk	
B.1.b	M (0)	M (0)			
B.1.c	L (1)	L (1)			
B.2.a(1)	M (0)	High Risk (-1)	High Risk (-1)		
B.2.a(2)	VL (2)				
B.2.a(3)	VL (2)				
B.2.a(4)	M (0)				
B.3.a	L (1)	L (1)	L (1)		
B.4.a	M (0)	M (0)	M (0)		

Overall Risk Rating

The Umatilla steelhead population does not currently meet the ICTRT recommended viability criteria because Abundance/Productivity and Spatial Structure/Diversity risks ratings are both moderate (Figure 7). However, the population does meet criteria for a "maintained" population. The 20-year delimited recruit per spawner point estimate is 1.50 with the lower end of the adjusted standard error above the 25% risk level, thus placing the productivity at low risk. The 10-year mean abundance of 1,472 is 98.1% of the minimum threshold of 1,500. Improvement in many of the Spatial Structure/Diversity metrics and a small increase in the average abundance will raise the population to viable status.

Abundance/ Productivity Risk	Spatial Structure/Diversity Risk →	**Very Low**	**Low**	**Moderate**	**High**
	Very Low (<1%)	**HV**	**HV**	**V**	M*
	Low (1-5%)	**V**	**V**	**V**	M*
	Moderate (6 – 25%)	M*	M*	M* **Umatilla**	
	High (>25%)				

Figure 7. Umatilla River Summer Steelhead population risk ratings integrated across the four viable salmonid population (VSP) metrics. *Viability Key: HV – Highly Viable; V – Viable; M* – Candidate for Maintained; Shaded cells-- does not meet viability criteria (darkest cells are at highest risk).*

Umatilla River Summer Steelhead – Data Summary

Data type: Dataset reconstructed from dam counts

SAR: Averaged Deschutes, Umatilla, Snake River, and Upper Columbia Steelhead series

Table 5. Umatilla River Summer Steelhead population abundance and productivity data used for curve fits and R/S analysis. Bolded values were used in estimating the current productivity (Table 6).

Brood Year	Spawners	%Wild	Natural Run	Nat. Rtns	R/S	SAR Adj. Factor	Adj. Rtns	Adj. R/S
1981	**1,115**	**1.00**	**1,115**	**2,635**	**2.36**	**0.68**	**1799**	**1.61**
1982	**609**	**1.00**	**609**	**2,640**	**4.33**	**0.46**	**1207**	**1.98**
1983	**974**	**1.00**	**974**	**2,525**	**2.59**	**0.52**	**1322**	**1.36**
1984	1,998	1.00	1,998	1,943	0.97	0.65	1257	0.63
1985	2,732	1.00	2,732	1,559	0.57	0.46	716	0.26
1986	2,487	1.00	2,487	1,017	0.41	0.94	959	0.39
1987	2,911	1.00	2,911	1,144	0.39	2.18	2490	0.86
1988	2,201	0.93	2,050	1,573	0.71	0.99	1558	0.71
1989	2,179	0.84	1,841	1,105	0.51	0.96	1062	0.49
1990	1,301	0.96	1,247	873	0.67	2.83	2471	1.90
1991	**700**	**0.85**	**592**	**593**	**0.85**	**2.33**	**1384**	**1.98**
1992	2,118	0.90	1,915	1,380	0.65	1.88	2594	1.22
1993	1,572	0.74	1,165	713	0.45	1.18	842	0.54
1994	**1,074**	**0.79**	**847**	**885**	**0.82**	**1.07**	**948**	**0.88**
1995	1,298	0.60	783	1,154	0.89	1.23	1414	1.09
1996	1,811	0.66	1,194	2,975	1.64	1.03	3070	1.70
1997	2,215	0.41	914	2,210	1.00	0.76	1687	0.76
1998	1,529	0.50	771	3,836	2.51	0.49	1880	1.23
1999	1,595	0.64	1,020	1,071	0.67	0.52	554	0.35
2000	2,621	0.77	2,030	2,584	0.99	1.00	2584	0.99
2001	3,353	0.73	2,444					
2002	5,172	0.68	3,542					
2003	2,822	0.71	2,015					
2004	3,109	0.64	2,003					

Table 6. Umatilla River Summer Steelhead population geometric mean abundance and productivity estimates (values used for current productivity and abundance are shown in boxes).

	R/S measures				Lambda measures		Abundance
	Not adjusted		SAR adjusted		Not adjusted		Nat. origin
delimited	median	75% threshold	median	75% threshold	1989-2000	1981-2000	geomean
Point Est.	1.24	1.79	1.14	1.50	1.07	1.06	1472
Std. Err.	0.24	0.33	0.19	0.15	0.02	0.06	0.22
count	10	5	10	5	12	20	10

Table 7. Umatilla River Summer Steelhead population stock-recruitment cure fit parameter estimates. Biologically unrealistic or highly uncertain values are highlighted in grey.

	Not adjusted for SAR							Adjusted for SAR						
SR Model	a	SE	b	SE	adj. var	auto	AICc	a	SE	b	SE	adj. var	auto	AICc
Rand-Walk	0.94	0.14	n/a	n/a	0.27	0.60	44.5	0.89	0.12	n/a	n/a	0.31	0.31	40.3
Const. Rec	1512	174	n/a	n/a	n/a	n/a	34.8	1438	147	n/a	n/a	n/a	n/a	30.2
Bev-Holt	22.07	116.06	1587	446	0.21	0.44	37.5	8.48	15.93	1625	425	0.20	-0.15	32.7
Hock-Stk	1.92	0.70	806	310	0.21	0.45	38.1	1.98	0.64	735	249	0.20	-0.18	32.8
Ricker	2.70	0.88	0.00060	0.00017	0.22	0.45	38.0	2.35	0.69	0.00055	0.00016	0.21	-0.14	33.4

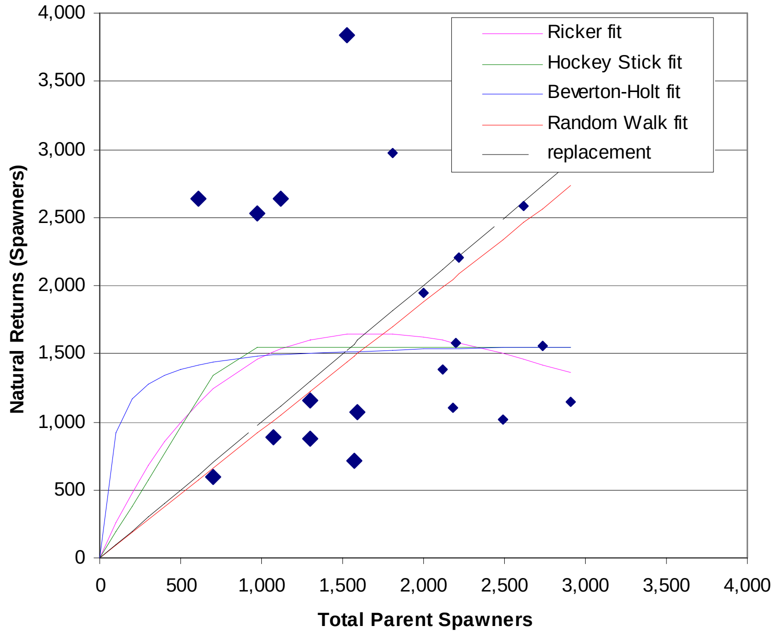

Figure 8. Umatilla River Summer Steelhead population stock recruitment curves. Bold points were used in estimating the current productivity. Data were not adjusted for marine survival.

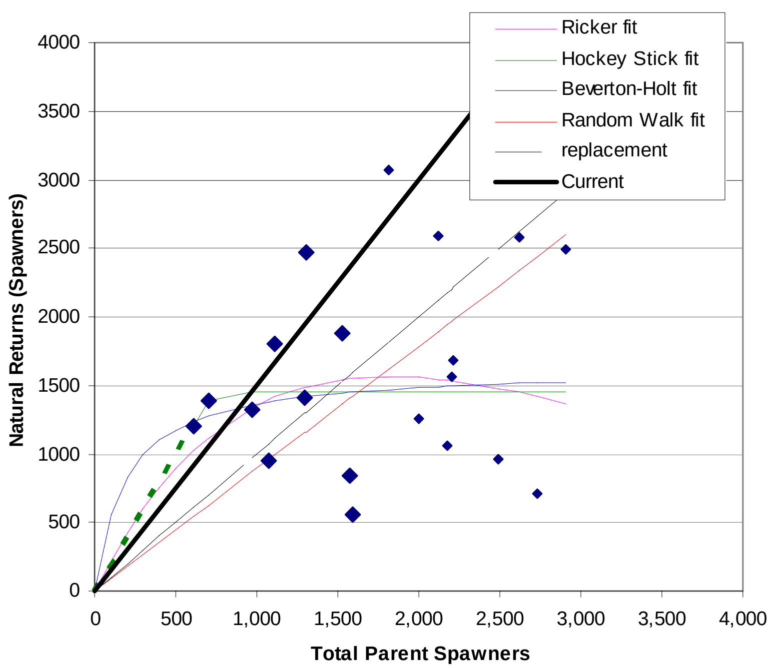

Figure 9. Umatilla River Summer Steelhead population stock recruitment curves. Bold points were used in estimating the current productivity. Data were adjusted for marine survival.